

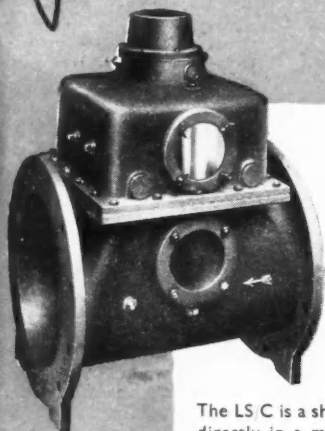
The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. LI
No. 1311

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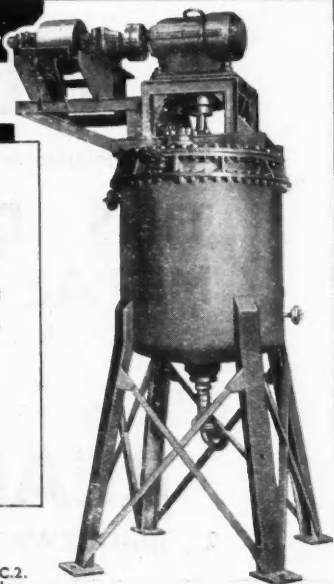
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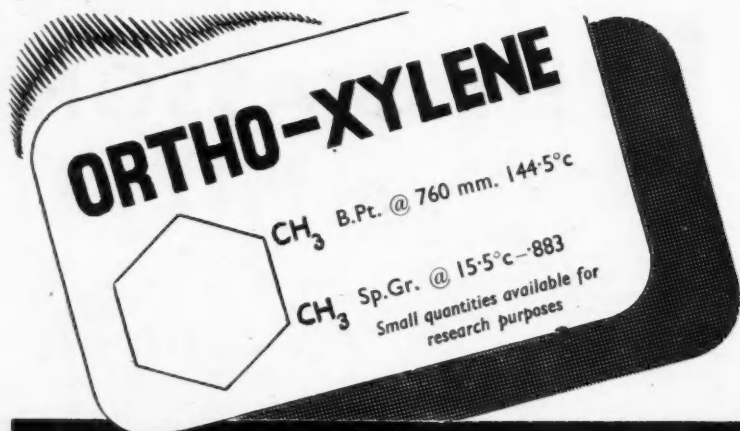
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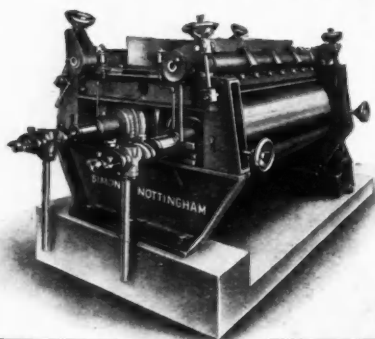
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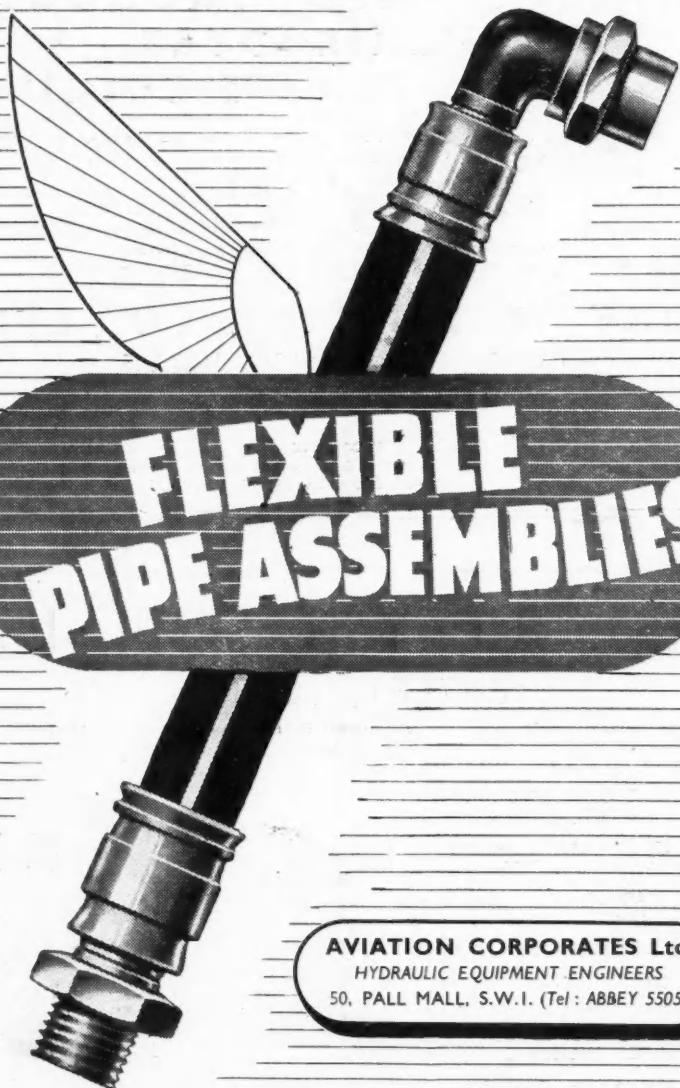
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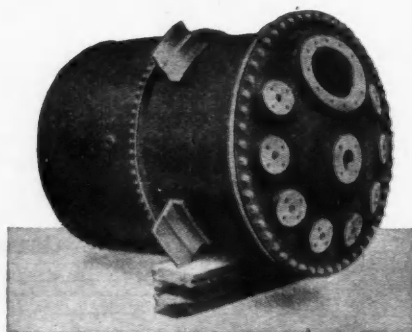
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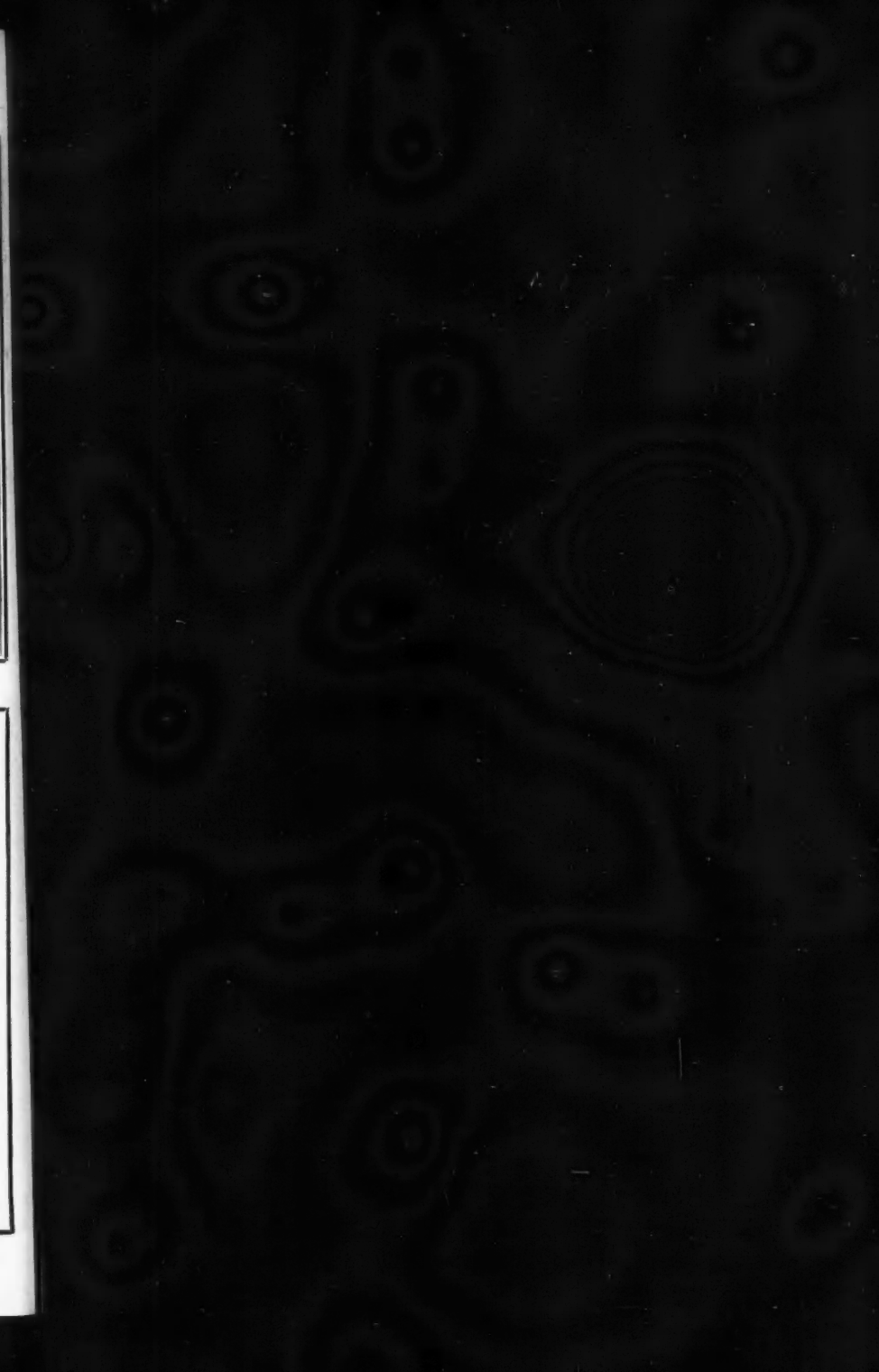
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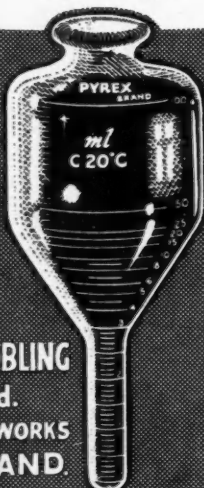


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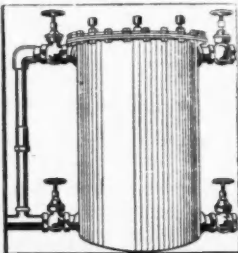
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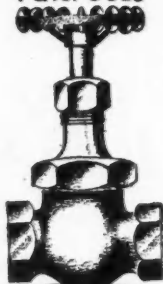
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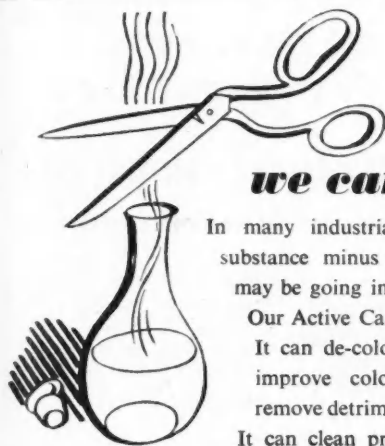
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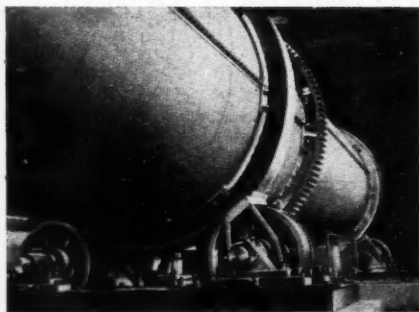
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Trade Associations

THE subject of Trade Associations, and in particular their position in the future scheme of affairs, has been hotly debated lately, following the issue of a "Planning" report by P.E.P. on the general subject of "British Trade Associations." Although based on ancient principles, the growth of this movement within recent years has been phenomenal; whereas in 1919 they numbered only about 500, to-day there are as many as 2500. It may be asked with propriety whether this growth is due to fashion or because trade associations have fulfilled a long-felt need. We have little hesitation in affirming that the movement has grown because of the value of the results. Business men do not follow the fashion blindly; they more often create it if they are worthy of their position. The trade association movement numbers all the best business men of the country within its ranks. It permeates the whole of British trade and industry.

The P.E.P. report does not exactly "define" what is meant by a trade association, but obliquely it states that "broadly speaking the term 'trade association' may be applied to any voluntary, non-profit-making association of financially sove-

reign business enterprises, formed to protect and advance the trading interests of its members." Definitions must be very carefully drawn up if they are to lead and not to mislead. It is arguable that this definition lends itself to misconception as suggesting that trade associations only exist to promote the profitable pursuit of a particular trade. In practice they do far more than this; they are a defence against practices which, if allowed to continue, would be not only to the disadvantage of the constituent firms but also to British industry as a whole.

The fact that the existence of a trade association is often not disclosed to the general public leads easily and indeed naturally to the charge that their practices are directed to ends that are of doubtful character.

There can be no question that this form of industrial organisation has taken a place in the economic life of America and Great Britain alongside that of the trade union. Workmen have for many years been allowed, in fact encouraged by the legislature, to band themselves together in order to protect and advance the interests of their members (in other words, to increase the profits of their members from

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only two branches of its activity). Without these developments, the mechanisation of the Reichswehr would have been impossible; and it is hardly necessary for us to say what that mechanisation has meant to the world.

DDT in the Limelight

FOR many months now the capacity of dichlorodiphenyl trichloroethane for killing insects has been discussed in technical circles with bated breath. Requirements of security have been well observed; so well, in fact, that even after the long-maintained secrecy came to an end with the publication of a considerable amount of technical data in the American press the authorities here found it hard to bring themselves to the point of releasing a small ration of information. *THE CHEMICAL AGE* first printed a news item about DDT four months ago and ever since then we have been trying to find out whether the insecticide was being made in Britain in substantial quantities. Now at last from the *Military Affairs* branch of the Ministry of Information comes a statement. "In the United Kingdom and the U.S.A.," it reads, "big manufacturing projects are in train and a steady flow of this life-saving compound is now ensured. In the U.K. all production is under the direct control of the Ministry of Supply, which has already set up a number of factories for the purpose and which has greatly simplified the task of production by pooling the ideas and experience of all the separate manufacturers. All the output is at present reserved for Service use." Which reads very much like the kind of answer the Minister of Supply gives when he is asked about penicillin in the Commons.

A Potent Insecticide

THE M.O.I. hand-out contains a few more facts that are likely to interest readers. DDT acts, it appears, as both a contact and a stomach poison, but it is non-toxic to man and other warm-blooded animals at the usual concentrations. It has been used successfully against bugs, fleas, lice, cockroaches, beetles, cabbage-worms, codlin moths, and aphids. It is effective many weeks after application; for instance, when spread on walls it kills any flies alighting thereon for as long as three months after-

wards; a bed sprayed with DDT is deadly to bedbugs for 3-6 months, while clothing impregnated with it is safe from lice for a month, even after several launderings. Although DDT was prepared as long ago as 1874, it was not until 1939 that the discovery was made by the Swiss dyestuffs firm of Geigy that it was lethal to bugs. Soon afterwards it was used to check a plague of potato-beetles in Switzerland. Geigy's British branch brought the compound to the notice of the British Government in 1942, and, after it had been shown to have valuable service uses, pilot-plant production was started and, in collaboration with the British Geigy Colour Co., plans for large-scale production were devised. Methods of air and land spraying are now being tested in Britain, Panama, and West Africa, and it seems likely that as soon as enough DDT is available the attempt will be made by spraying the insecticide from aeroplanes to disinfect huge areas where and when they are opened up as new theatres of military operations. From America it is reported that the Department of Agriculture is concerned lest the use of DDT on farms might lead to the destruction of beneficial insects as well as pests.

£12 Million in Pennies

THE Red Cross Penny-a-Week Fund, devised in 1940 as a convenient method of obtaining support for the Red Cross and St. John amongst the workers generally, has now reached a total of £12,000,000. Of this sum more than £6,500,000 has been contributed at their place of employment by workers in some 45,000 firms and organisations throughout the country, the remainder being raised by regular house-to-house collections. Large numbers of workers in a great variety of industries have willingly responded to the joint appeal of the T.U.C. and the British Employers' Confederation to increase the amount of their weekly contribution, and it is estimated that at the present time at least three million members of the Fund are contributing a minimum of 2d. a week. Recently the workers of one group of South Wales collieries decided to celebrate the beginning of the liberation of Europe by raising their weekly contribution to 6d., and no doubt others will follow their example.

Recent Developments in Analytical Chemistry—XI

(From Our Analytical Correspondent)

Nickel and Cobalt

SEPARATIONS and estimations involving nickel and cobalt have been the subject of a number of recent papers. Where iron is also present, it is recommended¹ that oxalic acid should first be added, followed by precipitation of the iron as hydroxide with ammonia. The presence of the oxalic acid prevents co-precipitation of the cobalt or nickel if the latter are not present in quantities more than ten times that of the iron. While traces of iron may not be removed by this method, they will not be sufficient to interfere with the subsequent determination of the cobalt and nickel. An alternative separation of cobalt and nickel from iron² involves oxidation of any ferrous iron to ferric iron by nitric acid. Potassium cobalticyanide is then used to precipitate the cobalt and nickel, and does not precipitate ferric iron. To separate nickel from cobalt, the same paper recommends transformation of the cobalt to cobaltcyanide, after which it is possible to separate the nickel completely by dimethylglyoxime. The cobalt, still in the form of cobaltcyanide, is now precipitated as copper cobaltcyanide, copper is removed as sulphide, and the cobalt finally determined by a cyanide titration.

A full discussion of methods of separation is to be found³ in another paper. Where small amounts of nickel and large amounts of cobalt are present, the cobalt should first be converted to cobalt ammonium phosphate. Equal parts of hydrochloric acid and a 10 per cent. solution of diammonium phosphate are added, and the solution warmed to 80° C. Ammonia solution (0.88 ammonia diluted with an equal volume of water) is then added until the precipitate first formed begins to redissolve. Stirring is continued until a crystalline lilac precipitate forms, which is filtered off and washed with cold water. Alternatively, the cobalt-nickel solution is poured into cold ammoniacal diammonium phosphate solution, warmed and stirred, and the cobalt ammonium phosphate filtered off. Nickel is precipitated from the filtrate by dimethylglyoxime. To remove the last traces of cobalt it may be necessary to give the solution a subsequent treatment with ammonium sulphide, the cobalt sulphide precipitate being flocculated on the water-bath, washed with warm dilute ammonium sulphide solution containing nitrate, ignited, and weighed as the oxide. However, as a general rule, less than 0.002 g. of cobalt is left behind after the phosphate precipitation.

Where the amounts of nickel and cobalt are approximately equal, the cobalt ammonium

phosphate is precipitated as before, but as it now may contain a small amount of nickel, it is redissolved and treated as already described for large amounts of cobalt with small amounts of nickel. The larger portion of the nickel, left behind in solution, is best estimated by a cyanide titration. If the nickel is present in large excess over the cobalt, the cobalt should be converted to cobaltamine by oxidation with persulphate, and then estimated either gravimetrically or colorimetrically. The phosphate precipitation can also be applied in the presence of iron. The solution is first treated with ammonium acetate and acetic acid, and ferric phosphate is precipitated. Under these conditions the cobalt does not precipitate, nor are cobalt or nickel adsorbed on to the iron precipitate. After removal of the iron precipitate the solution is rendered ammoniacal to induce precipitation of the cobalt ammonium phosphate as already described.

An alternative separation of cobalt and nickel⁴ makes use of the fact that the chlorides differ widely in their solubility in acetone. By extracting the chlorides with this solvent, cobalt chloride, being very soluble, is taken up completely, while nickel chloride, having a negligible solubility, remains behind.

Colorimetric Estimation

Colorimetric methods proposed for the estimation of cobalt use tripyridyl,⁵ o-nitrosoresorcinol,⁶ and ammonium thiocyanate and stannous chloride.⁷ Tripyridyl forms an orange-coloured complex with cobalt, which is unaffected between pH 2 and pH 10. The colour is most suitable for determinations on the range 0.5 to 50 parts per million, and since it is not very stable, fresh standards must be made up each day. The use of o-nitrosoresorcinol as a reagent for cobalt is a logical derivation of the well-known use of o-nitroso- β -naphthol. The complex given by the latter is not particularly suited for colorimetric work, since it is very insoluble. Solutions of the complex with o-nitrosoresorcinol, however, have been found to be stable for several weeks. The determination covers the range 0.05 to 250 parts per million where Nessler glasses are used (the spectrophotometer takes the lower limit even further down), but the sensitivity changes slightly over this range. The most suitable pH range is 5.6-6.3, throughout which the red colour is constant and at a maximum. A modification of the method makes it suitable for determining small amounts of cobalt in the presence of nickel up to 5000 times the

amount. The third cobalt method is especially worked out for traces of the element in electrolytic nickel. The cobalt is obtained, along with nickel and manganese, as oxide precipitate, which is dissolved in sulphuric acid and hydrogen peroxide. The solution is treated with ammonium thiocyanate, 20 per cent. stannous chloride, and hydrochloric acid, and the cobalt complex is extracted with acetone, being then compared colorimetrically with a standard.

A new method of testing for traces of nickel in presence of much cobalt has been described.⁸ The precipitated sulphides are dissolved in a little aqua regia, diluted and filtered. Sodium hydroxide is added, and the solution oxidised with bromine water, after which ammonium chloride and ammonia are added, and the whole thoroughly mixed. Nickel is converted to a soluble ammine, while cobalt is precipitated and may be identified by normal methods, and nickel in the filtrate may then be detected by dimethylglyoxime. The sensitivity quoted for this method, however, does not appear to be nearly so great as that for the other methods such as by employing potassium cyanide.⁹ The gravimetric estimation of nickel in the presence of considerable amounts of cobalt, by precipitation with dimethylglyoxime,¹⁰ is stated to be most accurate at pH 8.4-8.6, but if the amount of nickel is very small, the precipitate should be redissolved, converted to ammine, and estimated colorimetrically.

Finally, a spark spectrographic method for nickel and chromium in stainless steels, which avoids the necessity for addition of a standard element, and uses instead an ingenious calculation, has been described.¹¹

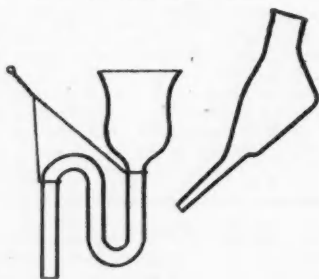


Fig. 1.

This method would probably be applicable, with appropriate variations, to other analyses. Ninety-eight per cent. of the steel is composed of iron, chromium, and nickel. Therefore, by determining the nickel:chromium ratio and the iron:chromium ratio, using the lines Ni 3087.1 Å, Cr 3169.2 Å, and Fe 3259.0 Å, solution of three simple equations will give the amounts of the elements separately, as follows: Let [Ni], [Fe], and

[Cr] represent the concentrations of the three elements to be determined, while x represents the Ni:Cr ratio and y the Fe:Cr ratio, x and y being determined from spectrograms. Then

$$\begin{aligned} \text{while } & [\text{Ni}] + [\text{Fe}] + [\text{Cr}] = 98, \\ & \text{and } \begin{cases} [\text{Ni}] - x[\text{Cr}] = 0 \\ [\text{Fe}] - y[\text{Cr}] = 0. \end{cases} \end{aligned}$$

By subtracting the two last of these equations from the first,

$$[\text{Cr}] = \frac{98}{1 + x + y}.$$

From this value [Ni] and [Fe] are directly given as $x[\text{Cr}]$ and $y[\text{Cr}]$ respectively.

Qualitative Analysis

Studies of the various reagents recommended for cerium,¹² thallium,¹³ and silver¹⁴ are accompanied by recommended reagents for these elements. For cerium the recommended reagents are sodium carbonate, phosphomolybdic acid, benzidine, ammonium anthranilate, and tetramethyl-diamino-triphenyl-methane. For silver the reagents *not* recommended include, it is interesting to note, the halide ions and chromate. To detect silver by a crystal test, solid rubidium chloride is proposed, although the test is subject to considerable interference. It is, however, sensitive to 1 in 100,000. On the spot plate acid ceric ammonium sulphate, which gives an orange-yellow colour, *p*-dimethylamino-benzal-rhodanine, which gives a violet-red precipitate, and acid manganous sulphate-potassium permanganate, which gives a brown colour, are the chosen tests. On spot paper the reagents chosen are metol, which gives a black stain, acid ceric ammonium sulphate and *p*-dimethylamino-benzal-rhodanine, while in the test-tube the tests which are recommended for the spot plate are favoured.

Two tests involving α , α' -dipyridyl have recently been proposed for the identification of cadmium. By the use of this reagent in ethyl alcohol together with aqueous ammonium thiocyanate,¹⁵ a complex $\text{Cd}(\text{dipyridyl})_2(\text{SCN})_2$ is formed, which is characteristically crystalline, and may be identified under the microscope. Zinc forms a complex in the same conditions, but the crystals of the zinc compound are distinguishable from those of the cadmium compound, whether formed separately or in the presence of each other. The other test depends on the formation of a complex iodide. The reagent solution is made by dissolving 0.25 g. of α , α' -dipyridyl and 0.146 g. of ferrous sulphate in 100 ml. water, and adding 10 g. potassium iodide. After half-an-hour's shaking the solution is filtered. The composition of the clear solution is the complex $\text{Fe}(\text{dipyridyl})_2\text{I}_2$, with excess potassium iodide. In order to test a drop of solution for cadmium, silver and thallium, if present, are first removed by hydrochloric acid, and lead, mercury, bismuth, and tin by ammonia. On spot paper

or in the centrifuge tube a red precipitate with a drop of the reagent now indicates cadmium. The test is effective in the presence of 5000 times as much copper or zinc. A similar reagent may be prepared by using *p*-phenanthroline in place of the α , α' -dipyridyl.

Apparatus

A number of funnels of various types and for different purposes, which may prove of use to the analyst, have been described. Two weighing funnels¹⁷ which enable the transfer of solids into standard flasks to be made easily and without loss are shown in Fig. 1. One of them utilizes a siphoning effect, produced on washing, to carry the last traces of the material across. Another funnel is designed¹⁸ for the transfer of solids or large amounts of liquids into flasks which are fitted with a standard ground joint (Fig. 2). Since the funnel is so wide, there is no tendency for solids to pack in it, and little or no danger of loss, while the whole assembly is relatively stable.

A funnel for a rather different purpose,¹⁹ the introduction of powders into capillary tubes, is shown diagrammatically in Fig. 3. It is made of brass, and the capillary is fitted into the tapering hole in the base, and held there. The usual practice of scraping the top of the funnel with a file will help to transfer the powder, while if the powder jams it may be loosened with a fine wire.

The use of an ordinary electric flat-iron as a hot plate for various micro operations is

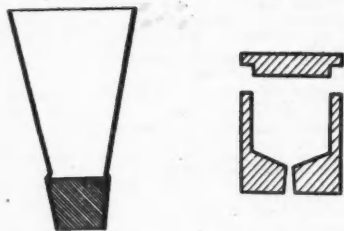


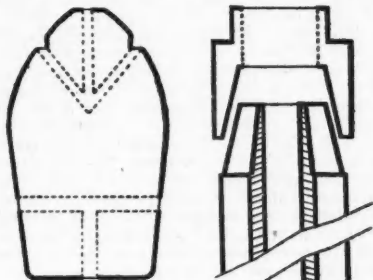
Fig. 2.

Fig. 3.

recommended.²⁰ Various holes may be bored, as shown in Fig. 4, to take a thermometer and capillaries, while micro-boiling-point determinations may be carried out simply by laying the capillary on the flat surface. The temperature of the surface will vary from place to place, but areas of equal temperature may be determined by evaporating a solution of a substance such as urea on the surface, and raising the temperature slowly, outlining on the surface the areas delineated by the molten portion of the urea at various stages.

In order to conserve Gooch asbestos in the routine filtration of precipitates which will be ignited, it has been suggested²¹ that a circle of filter paper should be placed on top of the asbestos after the Gooch has been prepared,

the whole being washed together to fix the paper firmly in position. After filtration, ignition, and weighing, inversion of the crucible together with light tapping will

Fig. 4.
(above)Fig. 5.
(right)

cause most of the precipitate and the filter paper ash to drop out, the remainder being easily removed by brushing. In this way the crucible is left ready for immediate re-use. If the technique is applied to porous porcelain filter crucibles where precipitates which tend to clog the filter are being handled, it will be found that this disadvantage is lessened considerably, in addition to cutting down the time required for cleaning the filter.

Electrographic Analysis

Several reviews have described the apparatus, methods and various applications of this comparative little-known technique^{22, 23, 24}. The detection of molybdenum in steel alloys²⁵ may be carried out using a current of 0.5-1.0 amp. and an e.m.f. of 6-9 volts for 1 to 3 seconds. A filter paper moistened with 30 per cent. sodium nitrate is used to receive the molybdenum, and after passage of the current this is washed with 1 per cent. lead acetate to remove heavy metal ions and to convert the molybdenum, which is now in the form of molybdate, to lead molybdate. This is now treated with a few drops of a solution made up by mixing equal volumes of stannous chloride (30 g. in 100 ml. hydro-

chloric acid) and molar potassium thiocyanate. The molybdenum-thiocyanate complex which is formed has a carmine-red colour. As the stannous chloride-thiocyanate solution is unstable, only a small amount should be prepared at one time.

Gold may be detected electrographically either by using a sodium-nitrate/hydrogen-peroxide test paper²⁶ which shows a purple stain in the presence of gold, or by using stannous chloride (10 per cent.) in dilute (10 per cent.) sulphuric acid.²⁷ A positive test in this latter case is a purple-brown stain, and there is no interference from about 40 common metals and alloys also tested. The stannous chloride test is particularly recommended for the recognition of gold plating.

Different from the electrographic method only in relying on contact alone for development of a test are the methods of contact printing,²⁸ using impregnated filter or gelatin-coated paper. The gelatin-coated paper technique has been found suitable for the identification of rust on steel.²⁸ By moistening the paper and pressing it against a steel surface for 15-30 seconds, subsequently "developing" it with hydrochloric acid containing potassium ferrocyanide, the presence of rust will be shown, while no colour will be given by a polished rust-free steel surface. A filter paper is used to test for manganese in steel by contact.²⁹ Nitric acid (1:1) is used to transfer the metal to the paper, which is then treated with 0.4 per cent. silver nitrate and saturated ammonium persulphate. Development of a permanganate colour implies a positive test.

Chromatographic Adsorption

Disadvantages of chromatography, as usually carried out, are the difficulty of removing the adsorbent column intact from the tube, and of determining at any stage the progress of the adsorption of a colourless chromatogram. Two adsorption tubes have been designed with these in mind. The first³⁰ is composed of glass plates held in position by cork separators and special clamps, giving the assembled tube a rectangular cross-section. In addition to ease of removal of the chromatogram, merely by taking the tube to pieces, it is stated that this type of cross-section is conducive to more regular adsorption throughout the column. The other type of column, shown in Fig. 5, may be made either of glass or of transparent plastic. A section is cut from the tube throughout its length, and this is held in position during operation by a block which fits over a tapered end, and a spring fitting in a groove at the other end. During the course of an experiment the adsorption may be interrupted to remove the section, so that the position of layers on the column may be ascertained by the direct application of reagents.

Two rather unusual applications of adsorption are to the analysis of gases and vapours,³¹ and to what has been called "chromatography

in reverse."³² In the analysis of gases, and of liquids of low molecular weight, the vapour is mixed with an inert gas which corresponds to the solvent in ordinary chromatography, and is passed through a suitably heated tube packed with silica gel as adsorbent. By this means a separation of benzene and cyclohexane, which gave optically pure first and last fractions, and 52 per cent. of a mixture containing less than 1 per cent. of benzene, was achieved. The other method consists in allowing a number of equal portions of adsorbent, in the form of a fine powder, to fall through a long column of solution. When the accumulated adsorbent is examined, it will be found that the most strongly adsorbed constituent of the solution will be concentrated in the bottom layers of the powder, and the less strongly adsorbed constituents at the top.

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Plans for developing Chile's industries announced by the National Corporation for the Development of Production include the investment of large sums of money in the manufacture of heavy chemicals. The Corporation has granted one firm a loan of 1,000,000 pesos to recondition its sulphate-of-alumina factory and instal a sulphuric-acid plant. Still another has been granted 10,000,000 pesos to increase production of soda ash, caustic soda, and sulphuric acid, while 4,000,000 pesos have been subscribed to finance an expanded output of drugs.

Preserving Timber Underground

Use of Dinitrophenol

THE chemistry of wood preservation, in particular the protection of mining timber, was the subject of a lecture by Dr. J. W. Bowen to the Chemical, Metallurgical and Mining Society of South Africa some time ago. In the March-April (1944) issue of the Society's journal have now been published Dr. Bowen's reply to various points raised in discussion of his paper. The efficacy of the constituents of triolith is one of the points he deals with. Prior to 1935, triolith was composed of sodium fluoride 55 per cent., sodium bichromate 35 per cent., and dinitrophenol 10 per cent. Owing to difficulties with export licences for chrome salts at the beginning of the war, the composition, at Dr. Bowen's suggestion, was changed to sodium fluoride 75 per cent., sodium bichromate 5 per cent., and dinitrophenol 20 per cent.

The toxicity of these salts, writes Dr. Bowen, varies considerably. Sodium bichromate under laboratory tests is almost useless as a preservative. This salt becomes fixed or chemically combined, apparently, with cellulose in wood, and even when used in reasonable concentration has no effect on wood-destroying fungi. In the original salt the effect of a concentration equal to 0.1 per cent. approximately, *i.e.*, 35 per cent. of the 0.3 per cent. concentration in which triolith was used can only be imagined. The effect of 0.015 per cent. in the present material does not require comment.

Sodium fluoride has been used with rea-

sonable success overseas, usually in a saturated solution, *i.e.*, at about $4\frac{1}{2}$ per cent. concentration. It can be classed in the same group of preservatives as zinc chloride, *i.e.*, a good water-soluble preservative. The position is somewhat different with triolith, however. This salt is being used at a concentration, in the present salt, of approximately 0.2 per cent., *i.e.*, 75 per cent. of 0.3 per cent. concentration. In other words it is being used at 1/25th of the strength considered necessary overseas.

Dinitrophenol is the effective agent in triolith. It is exceptionally toxic and is the worthwhile feature of triolith used at the present concentration. Even so at about 0.06 per cent. concentration, *i.e.*, 20 per cent. of 0.3 per cent., it can only slightly affect the length of service obtained from timber. A number of isomers of dinitrophenol occur. The solubility of the majority of these is very low in cold water. It is stated that the dinitrophenol in triolith is the 2:6 isomer, which is "very slightly soluble cold." The 2:4 dinitrophenol isomer is probably the most soluble, having a solubility of 0.56 per cent. at 18°C. It is recommended when using this material to dissolve the salt in hot water at about 80°C., but it is rather pointless when the temperature at which the preservative is to be used is approximately 20°C. Another feature of dinitrophenol is the danger of dermatitis which threatens native and white workers handling the salt.

New Uses for Acetone

Hints from Recent Patents

(From a Correspondent)

ALTHOUGH generally considered a staple chemical with a fairly limited although important field of utility, acetone is finding many new uses in a wide variety of processes. As an indication of the unexplored possibilities of this highly reactive chemical, a study of recent patents reveals many such applications. In the rubber-compounding field, for example, a typical new use for acetone is in condensation with aryl amide to produce an age-resister which is particularly effective at elevated temperatures. For inhibiting oxidation in rubber, another inventor recommends incorporating about 0.1 per cent. or more of a product of thermal reaction of a ketone such as acetone, and alcohol such as isopropanol, and a secondary diaromatic amine such as diphenylamine in

the presence of an acidic catalyst, with elimination of water.

One use for acetone in the metal-working field is its use in combination with boron trifluoride. An organic flux for soft soldering metals is obtained which is described as non-corrosive when left in contact with the metal to be soldered and yet which mildly, but uniformly, attacks the metal surface during the actual soldering operation.

To produce a solvent for de-waxing mineral oils, acetone is recommended in combination with amyl mercaptan. Certain treated waxy lubricating oil stocks of 70 seconds Saybolt universal viscosity, when mixed with such a solvent, are claimed to produce a dewaxed oil with a pour point of -15°C. A recent pharmaceutical application

of acetone is in dissolving the salt of calabash-cure as a preliminary step in purifying toxiferine. The patent also outlines subsequent steps in the process. Another new pharmaceutical use is in the extraction of stings and poison glands of bees; the acetone extract is then evaporated under vacuum, concentrated ethanol or methanol, and then 55-65 per cent. (aqueous) alcohol, being used for further extraction.

New Drying-Oil

New uses for acetone are discovered frequently, in the paint, varnish and lacquer industries, where this chemical has long been one of the most useful solvents. One recent application is found in a process for a drying oil composition claimed to possess improved hardness and adhesion, as well as greatly reduced wrinkling tendencies. It comprises an unsaturated condensation product of acetone in which tung oil is dissolved. A rapid, uniform method of producing a luminous coating for electric lamps was discussed recently, in which luminescent particles are dissolved in a medium of acetone, nitrocellulose, and dimethyl phthalate. Another inventor recommends the addition of aluminium and colloidal graphite suspended in acetone to lacquer intended for use on aircraft.

Organic Synthesis

Among its new uses in organic synthesis is one in which acetone is utilised in the preparation of a pure grade of hydroxylamine hydrochloride. Acetone is reacted with a mixture of nitric acid and hydrochloric acid to produce chloroisnitrosoacetone, which is dissolved in water, and reacted with chlorine gas; and then hydrolysed by means of dilute hydrochloric acid. The preparation of new emulsifying agents which disperse calcium soap also involves the use of acetone. Lauryl chloride is condensed with a sulphonic acid of *p*-toluidine or *p*-chloroaniline in the presence of an alkali, such as caustic soda ash, and acetone. An improved method of manufacturing vinyl crotonate makes use of acetone. Acetylene is brought into contact with crotonic acid in the presence of acetone and a catalyst at a temperature not exceeding 50° C.

U.S. CELESTITE PRODUCTION

In the United States tracer bullets and signal flares continued to provide a strong demand for domestic celestite (crude strontium sulphate) in 1943, while low-grade celestite was used in oil-well drilling muds, in place of the scarce barytes, states the U.S. Bureau of Mines. Shipments of celestite by producers amounted to 7,566 short tons valued at \$114,526, compared with 4041 tons valued at \$55,529 in 1942.

These figures include both chemical and non-chemical grades. The principal producers were the Pan-Chemical Co., the Milwhite Co., and Bennett-Clark Co. Celestite has been produced in Texas since 1938 as a weighting material for oil-well drilling mud in competition with barytes. Prior to March, 1943, ground barytes cost the driller considerably more than ground celestite, as there was a royalty of \$17 per ton on barytes in addition to its regular delivered price. But after March, 1943, in view of the reduced final price of the heavier barytes, celestite almost disappeared from the market.

The outlook for a celestite industry in the United States is not considered encouraging. When prices drop to peace-time levels, which may approximate \$12-\$15 a short ton c.i.f. eastern seaboard, it is unlikely that suppliers in California and Texas can compete with producers in England, Spain and Mexico. Nodular celestite separated from limestone matrix in Tennessee by crushing and jigging may find a more favourable market, however, owing to its purity and nearness to consumers.

Welsh Tin-Plate Trade

B.O.T.'s Attitude to Concentration

THE Board of Trade has now given its decision on the question of redundancy in the Welsh tin-plate trade. This was disclosed in a statement issued by the Welsh Plate and Sheet Manufacturers' Association last week after its annual meeting. The statement reads: "It was reported to a meeting of the Tin-Plate Association this afternoon that information had now been received that the President of the Board of Trade could not at this juncture see his way clear to approve the industry's scheme for the permanent elimination of the surplus productive capacity in the trade. The industry has always held the view that the disposal of this problem was an essential preliminary to the very important issues involved in reorganisation of its methods of manufacture, and the scheme had been unanimously adopted by the trade with this principle fully in mind.

"It is, therefore, with extreme disappointment that the industry learns of the attitude of the Board of Trade towards their efforts to proceed in an orderly way to a solution of the vital problems that will arise in the immediate post-war era."

Redundancy has been a burning question in the industry for some years now. Both the Essendon Committee (set up by the Board of Trade) and the Welsh Advisory Council for Reconstruction had urged concentration of the industry and the scrapping of redundant plant.

Magnesium Minerals

Recovery and Treatment of Natural Brines

IT is not only in this country that the better utilisation of natural mineral resources is a topic of vital interest; in the United States also, prospectors and scientists are combining in searching out and developing the vast mineral wealth of the North American sub-continent. In recent years, they have been spurred on especially strongly by the huge and growing demand for magnesium, and a recent article (by P. D. V. Manning and S. D. Kirkpatrick, in *Chem Met. Eng.*, May, 1944, p. 32) outlines some of the steps that have been taken towards utilising the riches of the soil in the production of that indispensable metal, together with the applications of chemical engineering technique that have brought the resultant raw materials to the stage of economic usage.

At the outbreak of war, the only raw material used for producing magnesium in the U.S. was magnesium chloride from natural brines. There was only a single producer, and it soon became obvious that other sources of raw material would have to be exploited. The story of how the Dow Chemical Company's research developed the process of magnesium recovery from the sea is well known, as is that of the treatment of dolomite as developed in Canada. Less familiar is the account of the way by which magnesium chloride was obtained as a by-product in the production of potassium sulphate in New Mexico.

Separation of Chlorides

With the discovery of potash, the area around Carlsbad, New Mexico, was developed until at the beginning of 1941 three deposits were being commercially exploited by as many different companies. Although these deposits are known to contain a number of wanted minerals, including sylvite, carnallite and langbeinite, only sylvite and langbeinite have thus far been found in grade and quantity to justify their commercial development. All three operators in the Carlsbad area produce potassium chloride from the sylvite ore and the processes used, although differing, consist essentially in the separation of potassium chloride from its mixtures with sodium chloride and other impurities.

In 1940, the Union Potash Co., which was subsequently merged with the International Minerals & Chemical Corporation, began the production of washed langbeinite, freed from salt by quick washing with water. Langbeinite is the double sulphate of potassium and magnesium, $K_2SO_4 \cdot 2MgSO_4$, and is found at the 800-ft. level in the International mine. It is a rare product, a saline residue from the evaporation of sea water,

and is associated solely with salt deposits. According to Dr. R. R. Sayers, of the U.S. Bureau of Mines, it has been found in only five countries.

To fulfil the demand for potassium sulphate, then unsatisfied because of the cessation of imports from Germany, a process was developed and installed for effecting an exchange of potassium and magnesium ions between sylvite and langbeinite, thereby precipitating potassium sulphate from the complex solution. Phase relationships are such, however, that it is not possible to recover all the potassium as the sulphate, and the solution left after the removal of the crystallised sulphate contains potassium, sodium, magnesium, chlorine, and sulphate ions in a concentration averaging about 30 per cent. of the contained solids. Of these constituents, the potassium and magnesium chlorides and sulphates are of value, but to realise this value, they must be separated from each other and from sodium chloride and sodium sulphate. A process for such a separation had been nearly completed at the beginning of 1941 when the Government began its search for magnesium chloride to be used as a raw material in alleviation of the shortage of magnesium metal.

Speeding-up Electrolysis

At that time, sure production of the metal was attainable only by the electrolysis of molten magnesium chloride and the Office of Production Management determined to build up quick production by that process. Sources of magnesium chloride were then sought. Available were only the brines from the Michigan wells and sea water. Experimental work on the reaction of dolomite with calcium chloride and carbon dioxide was under way, and some deep wells in Utah and Texas also showed promise of yielding magnesium chloride. However, owing to the serious difficulties encountered in the operation of electrolytic cells where the melted cell feed contained certain impurities, some of these naturally available brines could not be used because it was not economically possible to remove the unwanted constituents.

By study of phase relationships in the six component systems, $Na-K-Mg-Cl-SO_4-H_2O$, it appeared possible to produce a cell feed of magnesium chloride pure enough to be used as a source of magnesium in the fused electrolytic process. The Carlsbad ores contain only minute traces of substances other than those mentioned above and the process by which the ores are beneficiated and the potassium compounds produced is such that there is no tendency for

these impurities to build up in the system. Such rigid specifications, however, were very difficult to meet mainly because of the low sulphate content which was permitted in a product made from a raw material containing over 19 per cent. of SO_4 calculated on a moisture-free basis.

In the electrolysis of fused magnesium chloride by any process, the molten bath used in the magnesium cell is mainly a mixture of several chlorides such as NaCl , CaCl_2 , MgCl_2 , and KCl . Although some variation in the percentage of the components is allowable, it is only possible between certain definite limits, because such variation controls the important physical properties of the bath which, in turn, govern current efficiency and smoothness of operation of the cells. These properties include melting point of the bath, specific gravity, fluidity, surface tension, and electrical and heat conductivity.

Melting point is important because the bath must have the proper fluidity at a temperature high enough to maintain the metal in the molten state, but not much higher lest the liberated metal burn too easily. Specific gravity must be such that the particles of molten magnesium can rise to the upper part of the bath and agglomerate.

In order to maintain the composition of the cell bath within the required composition limits, the magnesium chloride cell feed

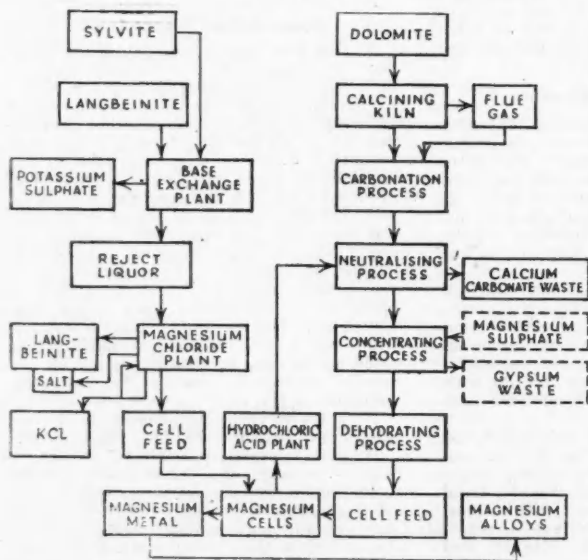
added must be pure enough for the composition of the cell bath to be maintained at the required point with the minimum removal of cell bath by dipping. When it is necessary to remove cell bath, costs are increased and there are likely to be minute particles of magnesium suspended in the bath, whereby some direct waste of metal may result.

Smooth operation of the cells can be attained only by holding the bath to a proper composition and keeping the feed free from dangerous impurities. The danger point of certain of these unwanted substances is as low as 50 p.p.m. of cell feed. Unless the metal is to be purified after production, all sources of impurity must be constantly watched.

Among the unwanted constituents in the brine available from International potash operations, the sulphate must be held as low as possible because it is decomposed in the cell with the ultimate formation of sulphur oxides, a corresponding amount of carbon from the electrode being used in the reaction, thus increasing the electrode consumption per unit of magnesium produced. The sodium and potassium chloride must be held low enough to permit their removal with the usual amount of sludge withdrawn from the cells in order to maintain a constant bath composition. For every ton of magnesium metal produced, almost four tons of anhydrous magnesium chloride must

be fed to the cells and, since it is impossible to produce magnesium chloride as a pure anhydrous solid, the actual cell feed to be added is nearer five tons per ton of metal produced.

In the development of any process for the manufacture of a chemical, considerations of equipment and materials of construction do not ordinarily impose such great limitations as are encountered in the production of magnesium chloride. The salt itself is very soluble and unfortunately so, too, are most of the compounds with which it is associated. In addition to this, solutions of magnesium chloride have a very high boiling point rise, which, of course, increases with the concentration. The characteristic, however, which is responsible for the greatest amount of diffi-



Process of manufacturing magnesium from sylvite, langbeinite, and dolomite.

culty is the hydrolysis of the chloride by heat according to the reaction: $\text{MgCl}_2 + \text{H}_2\text{O} = \text{MgO} + 2\text{HCl}$.

As the concentration of magnesium chloride increases, this hydrolysis progresses to an ever larger degree. Production of hydrochloric acid in this manner always results from concentration of magnesium chloride solutions and the corrosion of equipment is, therefore, the greatest limiting factor in developing any process for the production of magnesium chloride. For these reasons the use of multiple-effect evaporators in carrying out any concentrating operation which involves solutions of magnesium chloride is extremely difficult. Final dehydration of concentrated solutions also presents problems of considerable magnitude. In both cases, as the concentration of magnesium chloride increases, the temperature to which it can be heated with minimum decomposition decreases. At the same time the vapour pressure also decreases and the boiling point rise increases. In practice some hydrochloric acid is always formed and corrosion problems are inevitable.

In the finally developed process brine is fed to the third effect of a triple-effect evaporator of outside heater type, the bodies of the flash tank being of steel with acid-proof brick lining. Heater tubes and tube sheets are of Inconel, and vapour-piping, entrainment traps, and some of the heater shells are of Inconel-clad steel.

Principal Salts Encountered

The principal salts encountered in recovery of magnesium chloride from raw langbeinite are: Carnallite ($\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$), sylvite (KCl), halite (NaCl), langbeinite ($\text{K}_2\text{SO}_4 \cdot 2\text{MgSO}_4$), leonite ($\text{K}_2\text{SO}_4 \cdot \text{MgSO}_4 \cdot 4\text{H}_2\text{O}$), schoenite ($\text{K}_2\text{SO}_4 \cdot \text{MgSO}_4 \cdot 6\text{H}_2\text{O}$), kieserite ($\text{MgSO}_4 \cdot \text{H}_2\text{O}$), kainite ($\text{KCl} \cdot \text{MgSO}_4 \cdot 3\text{H}_2\text{O}$). These salts are removed by centrifugal filters while the solution is hot. The langbeinite phase is the point at which removal of the sulphate and sodium chloride from the system is effected. These salts are returned to the potash refinery for use.

After centrifugal separation, the clear liquid is fed to the first effect of the evaporator and the concentration is raised to a point at which a slurry, mainly of kieserite, carnallite, and halite, is removed for recycling, after being thickened in a small settler. To the hot overflow from the settler, water and potassium chloride are added and, after solution has taken place, the liquor is cooled in a batch crystalliser, pure carnallite crystallising out of the solution. The carnallite is filtered, washed, and leached with water, and is finally decomposed to form a concentrated solution of magnesium chloride containing small amounts of potassium and magnesium chlorides. The remaining potassium chloride is present in the solid phase.

The slurry is filtered and the filtrate is concentrated in a submerged combustion gas-burner evaporator, then chilled in the vacuum crystalliser. This brings about the formation of carnallite and is done to reduce the potassium chloride content of the solution. Filtration removes the carnallite which is returned to the process and the liquor is passed to spray driers where it is dried. The drying process is so rapid that only a small amount of decomposition takes place and the final product contains but a small percentage of magnesium oxide.

The ratio of magnesium chloride to water in the product is approximately represented by $\text{MgCl}_2 \cdot \text{H}_2\text{O}$. After collection, the powder is briquetted and shipped to Austin, Texas, where it is electrolysed in the modern Dow process plant which was designed and is operated for the Defense Plant Corporation by International Minerals & Chemical Corporation.

Magnesium Hydroxide Process

Magnesium chloride cell feed forms only a part of that fed to the electrolytic cells at Austin. Magnesium hydroxide also is produced at Austin from selected Texas dolomite. This, after calcining in a rotary kiln, is slaked in a continuous slaker and the resulting slurry is fed continuously to two series of three carbonators. Each of these is fed with gas from the dolomite kiln which has been scrubbed with water to cool and clean it. The gas is compressed and is delivered to the carbonators at about 5 lb. pressure. Carbonation proceeds until the calcium is entirely changed to the carbonate, control being effected automatically by electrical conductivity of the slurry.

The slurry is next passed through centrifugal filters which remove a portion of the water, the resulting cake passing to the neutralising section where, in turbo-mixer tanks, the magnesium hydroxide is neutralised with hydrochloric acid. There results a slurry of calcium carbonate suspended in a solution of magnesium chloride and the carbonate is removed by filtration.

The magnesium chloride solution is concentrated by means of a battery of submerged combustion evaporators to a content of approximately 34 per cent. magnesium chloride. At this point the residual calcium is removed as calcium sulphate and the solution concentrated and dehydrated to $\text{MgCl}_2 \cdot 1\frac{1}{2}\text{H}_2\text{O}$.

D.T.D. Specifications published by the Stationery Office include: No. 121D, Temporary Rust Preventive (6d.); No. 181A, Non-corrodible Steel Flexible Wire Rope (1s.); and No. 610, Aluminium-coated Alloy Sheets and Coils, Solution-treated (incorporating amendment list, 1s.).

Moth-Proofing Furs

New Toxic-Repellent Treatment

A DISCOVERY of considerable practical value in the moth-proofing of furs has been announced by I.C.I. chemists. This discovery involves a treatment with a solution of common salt and small quantities of other substances. The protection of furs, and keratinous fibrous materials generally, from the ravages of insects is a serious problem. The damage done by clothes-moths and, to a lesser extent by Dermestid beetles, in Britain alone is estimated to be approximately £1,000,000 a year.

It has been discovered that the treatment of proteinaceous fibres with a saturated solution of sodium chloride containing small concentrations of formaldehyde and hydrochloric acid renders the fibres highly moth-proof. The corrosive nature of this solution and its mode of application make its economic adoption doubtful in the wool trade, but it promises to be an inexpensive moth-proofing agent for furs. Fleeced rabbit skins are placed in a bath of saturated sodium chloride solution containing 1 per cent. formaldehyde and hydrochloric or sulphuric acid, the liquor ratio being 25/1. The best results are obtained at pH value considerably less than 2.0 and probably nearly 0.5. The temperature is maintained at 25-35°C. for a period up to two days and the skins are then removed, freed from liquor as thoroughly as possible, painted on the flesh side with a mineral oil fat-liquoring agent, and dried at ordinary temperature. The salt is removed by gentle brushing. The fur so treated is toxic to larvae, and experiments have shown that in addition when keratin fibres are so treated female clothes-moths are deterred from laying eggs on them. A further series of experiments has shown that dyeing with oxidation dyestuffs by any of the ordinary procedures does not interfere with the moth-proofing properties conferred on the furs by the treatment, nor is the shade appreciably affected.

An Inexpensive Process

The treatment should be inexpensive; for, besides the saturated salt solution removed with the skins, only slow exhaustion of hydrochloric acid and formaldehyde from the bath have to be compensated. The exhaustion of the acid and formaldehyde is easily followed by normal titrimetric procedures and the bath is brought back to its original concentration and re-used. The treatment involves no new step in normal fur processing, for it takes the place of the usual acid/salt pickle. It is true that the concentration of salt employed is somewhat higher than that used in the normal pickle. This should not, however, present great difficulty, and if deemed necessary could be

overcome by interposing a steeping in a salt solution of ordinary pickle strength between the treatment and the next stage in processing. The twofold nature of the anti-moth effect, repellency and toxicity, is interesting, especially in view of the observation that, while some of the commercially available moth-proofing agents are extremely toxic to larvae, they nevertheless attract the adult moths; with the result that more eggs than normal are laid on materials treated with these substances.

Figures demonstrating the efficacy of the process are given in an article by three I.C.I. chemists, published in *Chemistry and Industry* (August 5, 1944, p. 284).

Copper Accelerators

Their Use in Synthetic Rubber Production

THE discovery that copper, long avoided by the natural rubber industry, is a powerful agent in the production of synthetic rubber was disclosed at a recent meeting of the Division of Rubber Chemistry of the American Chemical Society by Dr. A. Somerville, vice-president of the R. T. Vanderbilt Co., New York. He believed that it would both improve the quality and increase the output of synthetic rubber.

In his address entitled "A GR-S Vulcanisation Catalyst" (see *Iron Age*, May 4, 1944), he described "Cumate" and "Cuprase" both of which are chemical compounds of copper. "These two accelerators are several times as powerful as the conventional type now in use in the rubber industry, and we believe that this greater activity is due to the fact that they are compounds of copper," declared Dr. Somerville. He was unable to say what was the mechanism of the reaction, but assured his listeners that there was no doubt of the effect of the copper. If a very small amount of 300-mesh copper powder is added to compounded Buna-S before vulcanising it is found that the time taken is less than half the normal. This experiment has been repeated hundreds of times in the laboratory with copper additions varying from 0.01 to 1 per cent. always with the same effect irrespective of copper content.

Dr. Somerville added that sixteen other metals in addition to copper were tried without effect. On the other hand, several chemical compounds of copper were tried and found to be effective. Laboratory tests up to date indicate that copper has no effect on butyl rubber or Thiokol.

The State Potash Mines in Alsace have been authorised to distribute the following dividends: for 1939, 2.70 francs per share; 1940, 2.25 francs; 4.27 francs for both 1941 and 1942.

Some U.S. Production Figures

New Records for Bromine and Sodium Carbonate

FIGURES for the 1943 production of bromine, calcium chloride, and sodium sulphates and carbonates have just been published by the U.S. Bureau of Mines.

Producers' sales of bromine compounds established a record in 1943—94,085,937 lb. of contained bromine valued at \$19,107,065, compared with 65,880,935 lb. valued at \$13,729,383 in 1942. The quantity of compounds sold was 111,205,096 lb. There were 14 producers in 1943, the same 14 as in 1942. Most bromine enters the market as ethylene dibromide, an anti-knock agent. The increasing tempo of the war has multiplied demands for motor fuels, and the growing output of high-octane spirit has increased the need for anti-knock fluids. Nearly all the ethylene dibromide used is made by the Ethyl-Dow Chemical Co., at Wilmington, N.C., and Freeport, Tex., from raw sea water, and the Dow Chemical Co., at Midland, Mich., from well brines. The Ethyl-Dow Chemical Co. began the construction of additional plant capacity at Wilmington and Freeport to meet the heavier demands anticipated. Prices were nearly all identical with those of 1942. Ethylene dibromide was quoted over a range of 65-70 cents a lb., f.o.b. plant. Potassium bromide, National Formulary grade, was quoted at 27-31 cents a lb; sodium bromide, same grade, was 27-30 cents (27 to 31 cents in 1942). Bottled elemental bromine was 25-30 cents a lb.

Calcium Chloride

Sales of natural calcium chloride and calcium magnesium chloride were well maintained, reaching 199,796 short tons (75 per cent. basis), valued at \$1,549,565, compared with 224,527 tons valued at \$1,733,169 in 1942. There were 11 producers in 1943, 13 in 1942. Calcium chloride is derived chiefly from three sources, sea-water bitterns, well brines, and by-product liquors of the ammonia-soda process. Sales of calcium chloride from the last-named source were estimated at 180,000 tons in 1943. Probably 90 per cent. of the total calcium chloride available from all sources is thrown away, the amount recovered depending on the market from year to year. Road stabilisation generally accounts for about half the total calcium chloride consumption, and surfacing of airfields and roads in military camps at home and overseas has also stimulated demand. Postponed roadwork and construction is expected to provide a good market for calcium chloride in post-war years.

Production of natural sodium sulphate in 1943 was handicapped by labour shortages,

and was 5 per cent. less than in 1942. On the other hand, production of natural sodium carbonate (all in California) established a new record, increasing 10 per cent. The respective figures for sulphate and carbonate were 165,908 and 165,993 tons. Of technical interest is the fact that one firm, Natural Soda Products Co., San Francisco, who recovered sodium carbonate at Keeler, Calif., from Owens Lake, Inyo County (which became a profitable source of natural salts when the City of Los Angeles diverted the flow of Owens River from the lake to an aqueduct in 1915, permitting the lake to evaporate) no longer precipitates sodium bicarbonate as the first raw material, but with the aid of flue gases carbonates further to the sesquicarbonate, which is precipitated, calcined, pugged, and recalcined to yield a dense soda ash.

Production data of sodium carbonate produced by the ammonia-soda process for the last three years were: 1941, 3,606,826 short tons; 1942, 3,788,583; and 1943, 4,407,618.

Salt Production

Increased war demands raised the total amount of salt sold or used by producers in 1943 to 15,214,152 short tons valued at \$43,878,266, compared with 13,693,284 tons valued at \$38,144,234 in 1942. The overall increase of 11 per cent. was accounted for by increase of 16, 14 and 8 per cent. respectively for rock salt, evaporated salt and brine. Of particular interest is the fact that over 66,000 tons of salt (exclusive of chlorine and other salt derivatives) was used in the manufacture of synthetic rubber. Some idea of the U.S. consumption of chlorine may be gained from the fact that 2,656,293 tons of salt went into its preparation in 1943. (It may be noted that over 3000 lb. of salt is required to produce one short ton of chlorine).

Production of boron minerals in 1943 recovered from the slump that occurred in the previous year. The total output of borax, anhydrous sodium tetraborate, kernite, boric acid and colemanite amounted to 256,633 short tons (B_2O_3 content = 87,600 tons), a figure exceeded only by the record output attained in 1941 (301,282 tons, with a B_2O_3 content of 95,200 tons).

Sales of natural and synthetic iron-oxide-containing pigments in 1943 totalled 100,666 short tons, a 3 per cent. increase over 1942. In view of negligible civilian construction activity, the increase pointed to expanded military uses. Iron oxide pigments find extensive application in flat camouflage paints for trucks, jeeps, artillery, and aircraft. Much yellow iron oxide is compounded with

chromic oxide to form the well-known olive drab shade. Paint for the shipbuilding programme required large quantities of both natural and synthetic red iron oxide in 1943.

The war has cut off or curtailed imports of many foreign earth pigments, including Turkey umbers, Italian siennas, French ochres, and Persian and Spanish red oxides, and for most purposes the American industry has been able to supply replacements which are as good or better than the foreign pigment, costs and quality considered. Possible exceptions are Persian and Spanish red oxides, for which no substitute seems to

have proved completely satisfactory. There is definite promise that the domestic pigment industry will supply most post-war domestic earth-pigment markets formerly dominated by foreign pigments.

Although research on infra-red reflecting earth pigments was continued with respect to war-time camouflage, at least one laboratory (in Canada) investigated the possibility of using infra-red reflecting paints for civilian uses, following up the theory that reflection of infra-red rays means reflecting heat; objects suggested for such painting were roofs and petrol storage tanks.

Electrochemistry in Spain

Possibilities of Extensive Industrial Development

WRITING in *Dyna* (April, 1944), Señor German Wilde discusses the possibility of introducing or extending certain branches of the electrochemical industries in Spain. As a striking example of the rapid development of these industries, especially under world war exigencies, he cites the case of aluminium. Production of this metal had by 1938 reached 580,000 tons, requiring some $1\frac{1}{2}$ million kW., equivalent to the total hydro-electric power of Spain. Other important parts of the electrochemical field are the manufacture of caustic soda, electrolytic zinc, copper and other metals, hydrogen, hydrogen peroxide, etc.; also calcium carbide, ferro, and other alloys. In the metallurgical field progress has been impressive, particularly in light alloys and in zinc production.

Use of Water Power

This last is of special interest for Spain, which has large supplies of water power, but little coal, and also possesses substantial deposits of zinc ore. Tests made with these ores in Santander and in the Eastern Pyrenees and Cartagena show that they can be easily dealt with by electrolysis. The sulphur ores or zinc pyrites are roasted in the usual way, the resulting sulphur being used for sulphuric acid production. The zinc sulphate solution is purified and then electrolysed. Using about 3500-3600 kWh. ton, zinc of 99.99 per cent. purity is obtained, which may be deposited directly on to sheet metal, wire, etc., to form zinc plate, etc., or employed very conveniently for production of zinc alloys for die-casting. As is known, electrolytic zinc is practically insoluble in dilute sulphuric acid whereas the ordinary impure metallurgical zinc is strongly soluble. The electrolytic zinc coating is so effective under bending that a layer of not more than 0.3 mm. in thickness is sufficient. With regard to metal sheets, six of these of standard size 760 by 530 mm. can be plated

at once, and since the time required for the electrodeposition of 30 gm./sq. metre of zinc is less than a minute, some 8-10 tons of zinc plate per day can be obtained from the galvanising bath. Such zinc plate can often be used effectively in place of tin plate.

The manufacture of the latter is carried out on analogous lines, but supplies of tin in Europe are limited, and even the large deposits available elsewhere, e.g., in Eastern Asia, are said to be limited to a life of no more than 30 years. Large quantities of tin are lost by throwing away empty tins (used in the food canning industries, etc.), the probable loss being in the neighbourhood of several thousand tons per annum. Attempts have long been made, of course, to recover some of this scrap, under the urge for waste prevention, which now and then stirs the conscience of the technical world. Meantime, the amount of tin required per square metre for effective coating has been greatly reduced by improved electrolytic methods, namely from 35 to 8 gm./sq. metre for dry goods (tobacco, coffee, etc.) and to 15 gm./sq. metre for fruit, fish, etc.

The advantages of using alkaline electrolytes are noted. These include the formation of a very thin alkaline layer under the tin coating and this serves, even through the microscopic pores in the tin, to neutralise the acid effect of fruit, etc. Another advantage is that these same solutions can be used for detinning when necessary, e.g., for removing excess tin which may accumulate on the edges of the metal sheets. An illustration and brief description of the well-known circular baths are given.

Chromium Plating

Chromium plating, though of much more recent introduction than the protective coatings of nickel, tin, copper, etc., has during the past few years achieved an important place in the metal-coating field.

Electrolytic bright chromium plating not only provides effective protection against atmospheric oxidation, especially in damp climates, but also against other forms of corrosion and wear. The latest improvements have resulted in the production of extremely thin yet effective coatings on many different kinds of metal and alloy surfaces. A particularly useful property of chrome coatings is that they permit of movement over or sliding action with other metals with a minimum of friction in cases where it is not possible to introduce lubricants. During the past five years the use of chromium-plated members in machine design has been wide and varied, including shafts, pulleys, i.e., engine cylinders, railway locomotives, machine tools, etc. The author thinks it not extravagant to claim that a revolution in machine construction has occurred on account of the merits of chromium plating. Also in the manufacture of chemical plant and equipment the strong protection afforded by chromium plating to most forms of corrosion has proved invaluable.

Production of hydrogen and oxygen by the electrolysis of water is a great branch of electrochemical industry which has made vast strides during the past fifty years. It is particularly valuable, of course, when both gases can find profitable use; sometimes oxygen is an unwanted by-product, yet even then this method of making hydrogen is to be preferred, especially where a high degree of purity is wanted, and in countries where cheap water-power is available—as in Spain. Moreover, it can be adapted to the power load of the station and affords a means of using to good purpose the off-peak current, thus damping out extremes of load requirements.

Demand for Knowles Cells

The author describes some of the principal types of apparatus, but for some reason does not include in these the well-known British type, the Knowles cell. [The omission of any reference to the Knowles cell is the more surprising since several plants of this type are already operating in Spain, as for instance at Barcelona and Bilbao. That these are giving satisfaction is indicated by the fact that one Spanish firm has written to the British manufacturers asking when it will be possible to import an additional plant.—EDITOR.]

After stating that patents concerned with electrolytic cells for water electrolysis now number more than a thousand, the author proceeds to discuss the relative merits of the different types of cell. Among the unipolar types, he considers the Fauser suffers, in comparison with the bipolar cells, from an excessive use of asbestos cloth for diaphragms; and this material being rather scarce in Europe, the less demand there is for it the better. The unipolar cells are also

said to take up more room for a given output and, being largely open to the air, are liable to carbonation of the electrolyte where this consists of an aqueous solution of sodium or potassium hydroxide. It is clear that the author favours the bipolar or filter press type, such as the Bamag, Siemens and Halske, I.G. Farbenindustrie or other German type. The author's illustrations include one of a plant, evidently of the filter press type but not named, now being installed in Spain by Nitratos de Castilla S.A.

Parliamentary Topics

Steel for Portal Houses

IN the House of Commons last week Mr. Innes Edwards asked the Parliamentary Secretary to the Ministry of Works the quantity and price of steel required in the Portal house. Mr. Hicks replied that the quantity of steel required, including the shed, was 5½ tons. The 1939 price of the sheet steel was £18 2s. 6d. per ton; the controlled price was now £24 15s. The prices for steel for the emergency house would be specially negotiated.

Tarmacadam

Mr. J. J. Lawson asked the Minister of Health if he was aware that in Circular 14/44 issued to local authorities there was no provision for methods of road construction other than by the use of concrete, thus apparently prohibiting the use of tarmacadam and penalising the coal-producing areas.

Mr. Willink answered that he had invited the Institution of Municipal and County Engineers to prepare a model specification for the use of tarmacadam similar to that for concrete, and when available this would be issued to local authorities for their guidance. Tarmacadam would rank for grant in the same way as concrete.

Penicillin—Enough Next Year

Questioned about penicillin, the Minister of Health gave the stock answer that all official supplies have been reserved for the Services and air raid casualties. He added, however, that production was increasing to the extent that it would shortly be possible to make some available for general civilian use and that it was expected that some time next year the supplies would be sufficient to meet all requirements. "I am advised," he continued, "that the preparation of penicillin requires the highest possible technical control in order to prevent the marketing of inferior and possibly dangerous preparations. For the present all supplies are obtained from the Ministry of Supply, who satisfy themselves through their staff of competent inspectors as to the quality of the

penicillin before issue. Regulations have also been prepared for prohibiting the manufacture of penicillin for sale except in accordance with a licence issued under the Therapeutic Substances Act, and in conformity with prescribed conditions, including tests for strength, quality and purity."

Location of Factories

Sir L. Lyle asked the President of the Board of Trade what steps were contemplated to penalise employers who did not feel able to approve suggestions for either the removal of their existing factory or the location of any part of it elsewhere; and whether this would take the form of refusal to licence or the withdrawal of the use of labour and material. Mr. Dalton replied that it was not part of the Government's policy to suggest the removal of existing factories, except where this might be necessary under local authority planning schemes.

Financing Research Associations

Replying in the House of Lords to Lord Barnby, Lord Templemore said that the D.S.I.R. made substantial contributions to research stations set up by industries, and there were already 27 established. With the exception of the cotton industry, research associations were supported by voluntary contributions. It had long been argued that all should contribute towards the cost, and the Government would be prepared to consider sympathetically a proposition for the introduction of enabling legislation for this purpose.

Personal Notes

MR. JOSEPH LAWS, of Widnes, a director of Orr's Zinc White, Ltd., has been appointed to the Lancashire County Magistrates' bench.

MR. T. CAMPBELL FINLAYSON has been appointed technical director of the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., in succession to Dr. E. W. Smith.

DR. G. F. LENNOX, of the biochemistry section, Australian Council for Scientific and Industrial Research, has been awarded the Grimwade Prize in industrial chemistry for 1944 by Melbourne University. The award was made in recognition of Dr. Lennox's researches on insect physiology and toxicology (which led to the development of a successful dressing for fly-struck sheep) and on skin proteins, proteolytic enzymes, and the loosening of wool fibres on sheepskins.

DR. N. P. ALLEN, who was elected chairman of the Birmingham section of the

Institute of Metals at its last meeting, on account of his appointment at the N.P.L., announced in this column last week, is resigning from the chairmanship.

MR. JULIAN L. BAKER, F.R.I.C., editor of the Journal of the Institute of Brewing, is among those upon whom the Fellowship of the City and Guilds and London Institute was conferred last week.

DR. STEPHEN JOHN WATSON, D.Sc., F.R.I.C., director-in-charge of the Jealott's Hill research station of I.C.I., has been appointed to the combined post of Professor of Agriculture at Edinburgh University, and Principal of the Edinburgh and East of Scotland College of Agriculture, in succession to Professor Ernest Shearer, who has resigned.

DR. EDWIN GREGORY, M.Sc., Ph.D., A.Met. (Sheffield), F.R.I.C., who has been assistant director of metallic materials inspection, A.I.D., has been appointed chief metallurgist to Edgar Allen & Co., Ltd., of Sheffield, in succession to the late Mr. S. J. HEWITT. Formerly lecturer in metallurgy at Sheffield University, he took up his appointment with the A.I.D. after six years as chief metallurgist of Park Gate Iron & Steel Co.

MR. THOMAS DONALDSON, director of Explosives Supply to the Australian Ministry of Munitions, has arrived in Britain on business. A Scot by birth, he obtained his early technical experience at Nobel's Ardeer Factory in Ayrshire before becoming chief chemist to the Modderfontein Dynamite Factory in South Africa. In 1929 he took the post of technical managing director to I.C.I.'s Explosives Group, and just before this war he went to Australia as technical consultant to I.C.I. of Australia and New Zealand, Ltd. In June, 1940, Mr. Donaldson was lent by his firm to the Ministry of Munitions, and he has since built up the explosives directorate to its present strength.

Obituary

From Australia is announced the death of MR. VICTOR THOMAS EDQUIST, the distinguished metallurgist, who died on May 4, aged 65. His metallurgical inventions included the Edquist process for the precipitation of gold on charcoal and its subsequent recovery by flotation; a water-softening process, which he presented to the Commonwealth Government, and which has been used on the Transcontinental railway; and many of the developments which have brought the use of suction gas power in mines to its present state of high efficiency. For most of his working life he was associated with the Sons of Gwalia Mine in Western Australia, and in 1942 he was president of the Australian Institute of Mining and Metallurgy.

General News

Paper salvage during the past 12 months has realised a total of 675,000 tons.

As a token of its goodwill, the Society of Chemical Industry has decided to subscribe to the Canadian Chemical Institute.

Palladium is to be used for making wedding-rings in place of platinum which is required for war purposes.

Trade with the liberated part of Italy is wholly on Government account, said the President of the Board of Trade in the House of Commons last week.

The latest "Fuel Efficiency" Bulletin, No. 32, of the Ministry of Fuel and Power deals with fuel economy at collieries, and has particular reference to the use of compressed air.

The scarcity of codeine is such that manufacturers are finding it necessary to ration supplies of the drug and preparations of which it is an ingredient, states the *Pharmaceutical Journal*.

The Ministry of Food announces that there will be no change in the existing prices of unrefined oils and fats and technical animal fats allocated to primary wholesalers and large trade users during the four weeks ending September 2, 1944.

De La Rue Plastics, Ltd., have acquired the whole of the issued share capital of Thomas Potterton (Heating Engineers), Ltd. Mr. Herbert Bridge, of Thomas De La Rue & Co., has joined the board of Pottertons. Mr. A. B. Potterton and Mr. T. F. C. Potterton will remain on the board of the company as joint managing directors.

The Royal Institution of Great Britain has established nine graduate memberships, three of which will be awarded annually to recent graduates, of either sex, of any university in the British Empire who have taken a degree with either first or second class honours in any scientific subject. Membership will give the holder the full privileges of members for three years, except the right to attend or to vote at any meeting.

"Science in the Universities" is the title of a shilling report published by the Association of Scientific Workers after submission to the University Grants Committee of the Treasury. It contains many interesting recommendations, advocating for instance that the syllabuses in the particular sciences need to be brought up to date and lightened of factual detail, so that basic principles are brought out, while it is suggested that practical work in vacations should be part of the syllabus for all scientists and not merely intended for those training for industry.

From Week to Week

Dr. Felix Singer's address on "Ceramics: Yesterday, To-day, and To-morrow," delivered to the Association of Czechoslovak Scientists and Technicians in London last February, has now been printed in booklet form (Communication No. 119), and may be obtained from the author at 46 Castlemaine Avenue, South Croydon, Surrey.

A report on costing has been published, price 1s., by the British Plastics Federation. The body responsible for producing this report, a sub-committee set up by the Federation's Injection Moulders Section, believes that a uniform method of costing is quite practical for the injection-moulding trade, and makes recommendations as to how cost accounting may be put into effect. A specimen cost-sheet is included in this document, which deals more specifically with cost finding than with estimating.

Stocks of high-grade scrap rubber are sufficient to cover all requirements for a considerable period ahead, stated the Parliamentary Secretary to the Ministry of Supply last week in explanation of the issue of the direction to local authorities relieving them of their obligation to collect scrap rubber. Mr. Peat stressed, however, that the crude rubber situation remains extremely critical and that there must be no relaxation of economy in the use of rubber, and of tyres in particular.

The Joint Chemical Committee on Patents which was set up recently at the instigation of the A.B.C.M. has held a number of meetings with a view to preparing a memorandum which will be sent to the Board of Trade's patents commission. The patents committee of the A.B.C.M. provided the nucleus around which grew the joint committee, on which are now represented the Chemical Society, the Society of Chemical Industry, the Royal Institute of Chemistry, the British Association of Chemists, the Biochemical Society, and the Wholesale Drug Trade Association.

Foreign News

Tung tree orchards are being planned by Chile's Ministry of Agriculture.

Penicillin is being made at the Oswaldo Cruz Institute, a Government research centre situated in Rio de Janeiro, Brazil. Small quantities of the drug have already been sent from there to Chile, Venezuela and Spain.

Irrigation water impregnated with ammonia is used as fertiliser on some farms in the San Joaquin Valley, California. The ammonia gas is fed from pressure cylinders supplied and worked by a contractor who regulates the ammonia flow.

Isonipeaine, marketed under the name of "demerol hydrochloride," has been placed by the U.S. Government under the same restrictions as apply to morphine.

A project that envisages an annual production of 20,000 tons of food yeast from molasses is being considered in South Africa, the Union's Department of Agriculture and the Industrial Development Corporation co-operating.

In many areas under German control, including Norway, liquid fuel is being withdrawn entirely from non-military use. The resultant strain on wood fuel for production-gas manufacture is becoming critical, and consumption of wood is exceeding natural replenishment by growth.

It is reported from Ottawa that the Canadian Government has given authority for a study to be made of international cartels and patent arrangements in their relation to Canadian interests. A committee for the investigation has been formed, directed by Mr. F. A. McGregor, Commissioner under the Combines Investigation Act.

Charcoal supplies in Germany have become subject to rigid control. A purchase permit from the control authorities is now required, the Reich Chemical Board explaining the tightening of control on the ground that demand has increased more rapidly than production. In the past purchase permits have been required only for certain uses, e.g., in producer-gas vehicles.

Tanning bark from old oak trees has been tested at the Kaiser Wilhelm Institute for Leather Research, Berlin. It is claimed by Professor Grassmann that old bark gives results similar to those obtained with young bark, in Germany, though the colour of the leather is somewhat reddish and on the whole darker than normal. Better results were achieved when valonia was added.

Etablissements Kuhlmann paid 104.5 million francs in taxes last year, it was stated in the shareholders' meeting. This amount is equal to 228 per cent. of the gross dividend. While production early in 1943 was about as high as in the previous year, the January-May period of the current year shows a decline in deliveries. Francolor distributed a dividend of 5.5 per cent. for 1943.

Another cut in German fertiliser supplies has been announced. For the year 1944/45, farmers will be allowed to buy only 80 per cent. of their 1943/44 quota of nitrogenous fertilisers, so that their maximum consumption will be down to 40 per cent. of the pre-war quantities. No more than three-quarters of the new quotas may be delivered before mid-November, while surplus quantities in the hands of distributors and producers must be reported to the Nitrogen Syndicate.

A new textile, made by the Owens-Corning Fiberglas Corporation and combining glass and asbestos fibres, is being used to protect the retractable landing gear of American aircraft from the hot exhaust of the supercharger. The material is intended for applications requiring high strength combined with light weight, and resistance to abrasion, high temperatures and corrosive fumes.

Sodium carboxymethylcellulose, a cellulose derivative soluble in water, has been introduced by the Hercules Powder Co., Wilmington, Del. Its properties make it a stabiliser and emulsifying agent, and it is expected that the material will be useful where hydrophilic colloids possessing marked suspending, thickening, stabilising, and film-forming properties are required.

Three marketing agencies centred on Nordhausen, Stuttgart, and Saarbruecken, respectively, will control the distribution of the entire German gypsum output. The German gypsum industry is at present largely unemployed, although the industry claims to possess the greatest deposits in the world and to be preparing new kinds of gypsum products suitable for utilisation in the reconstruction of bombed towns.

New records in production and sales of domestic potassium salts in the United States were again made in 1943. Nearly 1,500,000 short tons of marketable potassium salts containing 739,141 tons of equivalent potash (K_2O) were produced. A somewhat smaller quantity (1,401,271 tons) was sold. This, according to reports from the producers to the Bureau of Mines, contained 732,151 tons of equivalent potash. Stocks in producers' hands at the end of 1943 were larger than in any of the three previous years.

The treatment of fruit-tree buds with chemicals in order to retard growth and so avoid the losses that fruit farmers suffer through late frosts is covered by a new U.S. patent, No. 2,341,867, granted to A. E. Hitchcock and P. W. Zimmerman, of the Boyce Thompson Institute for Plant Research, Yonkers, New York. Naphthalene-acetic acid, naphthoxyacetic acid and their alkali metal salts are specifically mentioned in the patent, and these compounds, it is stated, may be applied to the buds of trees by spraying.

The reaction of butadiene with benzene in the presence of sulphuric acid and hydrogen fluoride (as catalysts) has been studied by V. N. Ipatieff, Herman Pines, and R. E. Schaad, of the Research Laboratories of Universal Oil Products Co. Results published in *J. Amer. Chem. Soc.* (1944, 66, 5, p. 816) show yields of 1,2-diphenylbutane amounting to 14 per cent. (on the basis of the benzene which reacted) using sulphuric acid, and 59 per cent. with hydrogen fluoride.

According to a report in the Palestine industrial journal *Hataassiya*, a new ceramic abrasive, called "Rupo Material," has been manufactured in Jerusalem, from locally obtained materials, by Dr. R. Pollak, formerly of Prague. It claims to have a polishing effect on hard steel equal to that of corundum, and it can be utilised also in the production of anti-corrosion vessels and piping, and as paving material.

Urea is being allocated by the U.S. War Production Board to manufacturers of cattle feeding stuffs. The problem of overcoming the hygroscopic and caking properties of the compound has been largely overcome by research in the laboratories of Du Pont's Ammonia Department and other research centres. For addition to cattle-feed, one urea preparation that is marketed has a nitrogen equivalent (per lb.) of 2.62 lb. of crude protein.

Conversion of surplus synthetic ammonia to ammonium nitrate in a form suitable for use as fertiliser was described by the Canadian Minister of Munitions and Supply, in an address to the Canadian Manufacturers Association, as an important peacetime possibility. Use of cheap fertiliser developed from surplus ammonia would be highly valuable for both farms and forests and might cut the period of forest growth by two-thirds, he said.

Fair yields of myosmine, a comparatively rare alkaloid with the formula $C_8H_{11}N_2$, have been obtained by the pyrolysis of nicotine over quartz at 570°C . This pyrolysis has been studied by C. F. Woodward, A. Eisner and P. G. Haines, of the Eastern Regional Research Laboratory, U.S. Department of Agriculture, and the results recorded in *J. Amer. Chem. Soc.* (1944, 66, p. 911).

Chemists of the Richmond laboratories of California Research Corporation, a Standard Oil subsidiary, have developed a lubricating oil which thickens when heated and thins on cooling. The effect depends upon the addition of finely-divided resins; at ordinary temperatures the resin particles do not affect the viscosity, but on heating, the polymers dissociate, so increasing the viscosity. When cooled, polymerisation occurs and the viscosity decreases.

Brazil's citric acid production is rapidly increasing and it is expected that a certain amount of the chemical will become available for export. Before the war Brazil was importing over 200,000 kg., principally from Italy and Germany. Now the Fazenda Amalia plant of I.R.F. Matarazzo is turning out 400 kg. a day, while the daily capacity of this plant could reach 1000 kg. Industria Brasileira de Produtos Químicos, Ltda., Sao Paulo, has a monthly production of $7\frac{1}{2}$ tons

of liquid citric acid, equivalent to approximately 2 tons of crystals. Brazil's monthly consumption is estimated at 15,000 kg.

Forthcoming Events

The Institution of Chemical Engineers is holding a joint conference with the Institute of Physics and the Chemical Engineering Group at the Royal Institution on September 22 and 23. The subject is "Instruments for the Automatic Controlling and Recording of Chemical and other Processes." Further particulars are obtainable on application to the Organising Secretary Joint Conference, Institution of Chemical Engineers, 56 Victoria Street, London, S.W.1.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Satisfactions

ZINC ALLOY RUST-PROOFING CO., LTD., Rochester, (M.S., 12/8/44.) Satisfaction July 19, of mortgage registered October 16, 1926.

Company News

The Standard Chemical Company announces a dividend of 50 cents per share (\$1.25) for the year ended March 31.

Peter Brotherhood, Ltd., have declared a total ordinary dividend of 20 per cent. (same) for the year ended March 31, and report a net profit of £44,534 (£48,873).

Van den Berghs & Jurgens, Ltd., report a net profit for 1943 of £799,824 (£815,493), and have declared a dividend of 8 per cent., tax free (same), on ordinary stocks.

A. Boake, Roberts & Co., Ltd., announce a final ordinary dividend of $1\frac{1}{2}$ per cent., making 9 per cent. (same) for the year ended March 31. Net profit was £48,822 (£46,785).

Celacite & British Uralite, Ltd., are paying a dividend of 10 per cent. (same), for the year ended March 31. Trading profit was £1273; net loss £9227 (net profit £8679); forward £41,272 (£55,628).

Newcastle-upon-Tyne Zinc Oxide Co., Ltd., of Sunderland, have increased their nominal capital by the addition of £30,000 in £1 ordinary shares to the registered capital of £60,000.

W. J. Bush & Co., Ltd., report a net profit for 1943 of £179,787 (£153,304), and are paying a final ordinary dividend of 6 per cent., making 10 per cent. (same). Forward, £213,829 (£190,767).

George Kent, Ltd., are paying a final ordinary dividend of 7 per cent., making 10 per cent. (same) plus 2½ per cent. bonus. Profit for the year ended March 31 was £32,944 (£35,159); forward £37,569 (£40,132).

Metal Industries, Ltd., have declared a final dividend, for the year to March 31 last, of 6 per cent. on "A" and "B" ordinary stocks, making 8½ per cent. (8 per cent.) for the year. Net profit was £117,938 (£126,816).

British Oil and Cake Mills, Ltd., report a rise in net profits from £400,556 to £547,286 for 1943, and are paying a dividend of 3 per cent. (nil) on ordinary stock, the whole of which is held by Lever Bros. and Unilever, Ltd.

The Gas Light & Coke Company, for the half-year ended June 30, has declared an ordinary dividend of 2½ per cent. (1½ per cent.). Full fixed dividends for the half-year are also being paid on the 4 per cent. and 3½ per cent. preference and the 3½ per cent. maximum stocks.

Thomas De La Rue & Co., Ltd., report a gross profit of £311,629 (£308,478 for 15 months), for the year ended April 1. The final ordinary dividend of 30 per cent. makes a total of 40 per cent. for the year, comparing with 35 per cent. for the previous 15 months. Carry forward is £75,387 (£68,158).

The directors of **Benn Brothers, Limited**, recommend the payment of the following dividends, less tax, for the year ended June 30: 3 per cent. on preference shares, making 6 per cent. for the year (same); 12½ per cent. on ordinary shares, making 17½ per cent. for the year (15 per cent.); 3s. 6d. (3s.) per share on the deferred shares.

New Companies Registered

Vermac Research Laboratories, Ltd. (389,022).—Private company. Capital: £200 in 200 shares of £1 each. Consulting chemists, experts in chemical research, etc. Subscribers: H. W. Bowles; W. F. G. Allardice. Registered office: 11 Grosvenor Street, London, W.1.

Munro Vitarex, Ltd. (388,761).—Private company. Capital: £1000 in 1000 shares of £1 each. Manufacturers of and dealers in chemicals, drugs, disinfectants, fertilisers, etc. Directors: A. H. Munro; Mrs. F. G. Munro; R. V. Fenn, F.C.S. Registered office: 6 St. Faiths Road, London S.E.21.

Dexter Paints, Ltd. (388,737).—Private company. Capital: £10,000 in 10,000 shares of £1 each. Manufacturers of and wholesale and retail dealers in paints, varnishes, enamels, etc. Directors: C. Eatough. (permanent governing director); J. C. Eatough;

H. C. Eatough. Registered office: 18/20 Sandygate, Burnley, Lancs.

Brighton Chemical Co. (388,893).—Private company. Capital: £1000 in £1 shares. Objects: To acquire the business carried on by Harry Dennison at Six-Lane-Ends, Heckmondwike, as manufacturers of and dealers in chemicals, paints, oxides, etc. Directors: J. Morris; J. Dennison. Registered office: 177 Stoneygate Road, Leeds, 6.

Rosko Rubber Cement and Chemical Co., Ltd. (388,973).—Private company. Capital: £2500 in 2500 shares of £1 each. Manufacturers of and dealers in waxes, rubber cements, inks, stains, dressings, polishes, etc. Subscribers: A. Papworth; C. Goddard. Registered office: Aylestone Lane, Wigston, Leics.

Highdale Soil Laboratory, Ltd. (388,883).—Private company. Capital: £2000 in 2000 shares of £1 each. Manufacturers of and dealers in fertilisers, insecticides, fungicides, chemicals and agricultural requisites, research workers, etc. Directors: G. E. M. Macey; W. F. Clarke; C. T. Mitchell; N. Couve. Registered office: 4 Bucklersbury, London, E.C.4.

Chemical and Allied Stocks and Shares

STOCK markets have shown a cheerful tendency in response to the war news, and prices recorded a renewed rise in most sections. British Funds were buoyant, reflecting the longer maturity of the new issue of 3 per cent. Savings Bonds. Industrial shares continued to respond to hopeful views of post-war dividend prospects when E.P.T. is abolished. Imperial Chemical were steady at 40s. 3d., as were B. Laporte at 85s., and W. J. Bush ordinary at 66s. 3d. British Oxygen at 90s. 6d. recorded a big rise on balance, partly on market expectations that, when additional capital is required, new shares may be offered to shareholders on terms involving a bonus. British Aluminium were better at 51s. 9d., Borax Consolidated deferred firm at 40s. 3d., and Metal Box ordinary at 94s. 3d., while the possibility of an improved dividend and hopeful views of post-war prospects maintained firmness in Triplex Glass at 45s. Dunlop Rubber were in demand and moved higher at 49s. 6d. Wall Paper Manufacturers deferred were also higher at 47s. Murex were 105s. While reflecting the further acquisition made by the company's plastics subsidiary, De La Rue moved higher at 190s., British Match were 45s., General Refractories slightly easier at 18s. 3d., Nairn & Greenwich, 80s., and Barry & Staines 54s. 3d.

Turner & Newall at 85s. 9d. have been quite well maintained on balance, as have

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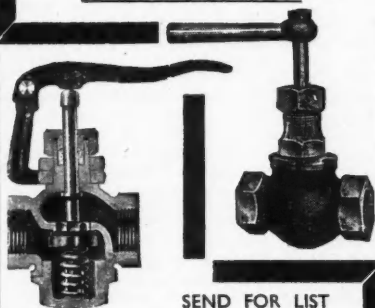
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United Molasses at 39s., but, although active, British Plaster Board at 40s. 6d. have not held best prices recorded in the past few days. Associated Cement were better at 70s. Expectations that the full results will show the increased dividend to be a conservative payment maintained firmness in Richard Thomas 6s. 8d. units at 12s. 10½d. Babcock & Wilcox eased to 53s. 6d., but Stewarts & Lloyds remained firm at 58s. 4½d. Dorman Long were 28s. 3d., Consett Iron 6s. 8d. ordinary 8s. 7½d., Guest Keen 41s. 9d., and Tube Investments 110s. 6d. United Steel eased slightly to 26s. 9d. Textiles were active and quite well maintained, apart from British Celanese, which on balance eased slightly to 30s. 7½d.; Courtaulds at 59s. have not held best prices. Bradford Dyers at 25s. reflected market hopes of an improved dividend for the current year. Calico Printers were firm at 17s. 3d., there being hopes that the latter company will shortly announce an increased payment on account of preference dividend arrears.

Boots Drug have been active, but at 58s. 3d. lost part of an earlier improvement. Timothy Whites were 39s. 6d., and Sangers 28s. 10½d., while Beechams deferred rose further to 20s. 9d. pending publication of the full results. Greeff-Chemicals Holdings 5s. units were 8s. 6d., Burt Boulton 24s. 6d., Cellon 5s. ordinary 25s., and British Drug Houses 28s. 6d. Ernicoid were 11s. 6d., and British Industrial Plastics 7s. 9d. The units of the Distillers Co. at 106s. 3d. held all but a small part of their recent large advance, the outlook for the company being regarded as good in the market in view of its diversified interests; the prevailing assumption is that in due course the pre-war dividend level is likely to be at least maintained. Low Temperature Carbonisation 2s. ordinary changed hands around 3s. Gas Light & Coke ordinary at 22s. 9d. lost part of the rise which followed the half-yearly dividend announcement. Electrical equipment shares were firm, with General Electric 98s. Johnson & Phillips 79s., and Associated Electrical 56s. Paint shares kept firm, with Pinchin Johnson higher at 42s. 6d. Oil shares reflected the upward tendency of markets, including Anglo-Iranian, whose preliminary results are imminent.

British Chemical Prices

Market Reports

A FAIR volume of inquiry has been circulating for the majority of the industrial chemicals, and actual bookings during the week have been on a moderate scale. Contract deliveries are proceeding along steady lines and, in the majority of cases, dealers report a good movement into consumption. In the soda products market, bicarbonate of

soda is being taken up in good quantities with quotations well held, while a steady inquiry is in circulation for bichromate of soda, Glauber salt and salt cake. The demand for nitrate of soda and yellow prussiate of soda is well maintained, with supplies scarce. The hyposulphites of soda are firm. There has been no change of importance in the potash section. A steady inquiry is reported for acid phosphate of potash, and there is a brisk movement into consumption of permanganate of potash and caustic potash, with supplies of yellow prussiate of potash still scarce. In other directions, formaldehyde is a strong market, while glycerine, both crude and refined grades, is the subject of steady inquiry and producers are well sold. Supplies of arsenic are quickly absorbed, and a fair trade is passing in alum. Makers of the red and white leads have indicated no change in the price position, and a steady business in most descriptions is being put through. In the coal-tar products market, trade on the whole has been of moderate dimensions, with contract deliveries of carboic acid and cresylic acid continuing on steady lines. An active interest is displayed in the toluols and benzols, and a fair trade is passing in the pyridines.

MANCHESTER.—With the holiday season at its height and the added interference arising from the Bank holiday spell, trading conditions on the Manchester chemical market during the past week, in respect both of new bookings and the movement of supplies against existing orders, have been relatively slow in most departments, including the by-products. An early recovery is, however, generally expected, more particularly as regards the movement into consumption. In the meantime, market conditions have been stable all round and there is no easing of prices in any direction.

GLASGOW.—In the Scottish heavy chemical trade home business has now resumed its normal activity after the annual holidays, and business has been moderate. Export inquiries are rather limited. Prices remain firm, with no actual changes.

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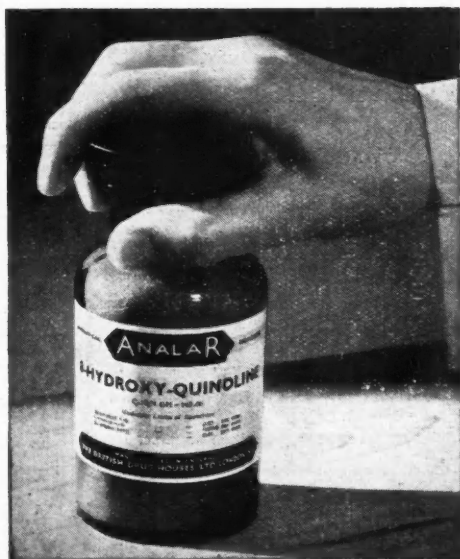
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Horizontal open top unjacketed double trough MIXER by Harrison Carter; cast iron mixing tank 4 ft. 0 in. by 2 ft. 2 in. by 1 ft. 4 in. deep; two horizontal shafts fitted 12 propeller type blades forming spiral.

Horizontal drum type unjacketed MIXER or KNEADING MACHINE by The London Kneading Co.; mild steel drums 3 ft. 8 in. long by 3 ft. 0 in. dia.; cast iron ends; internal horizontal blades and two breaker flaps; loading and discharge door 2 ft. 0 in. by 1 ft. 4 in. with quick release cover.

Horizontal mild steel tilting pan MIXER by Hodgkinson; pan 1 ft. 2 in. by 1 ft. 2 in. by 1 ft. 7 in. deep fitted twin Sigma blades driven through gearing from f. and l. pulleys; interlocking device with striking gear, fitted with cover.

Horizontal cast iron Pug MIXER with 'U' shaped trough 1 ft. 10 in. by 2 ft. 0 in. by 2 ft. 0 in. deep; horizontal shaft fitted with finger blades and driven through gearing from f. and l. pulleys; hinged cover and bottom slide valve discharge.

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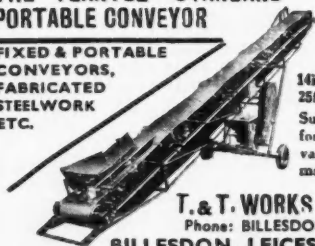
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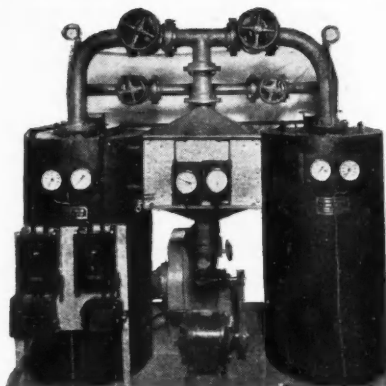
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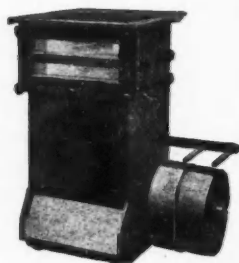
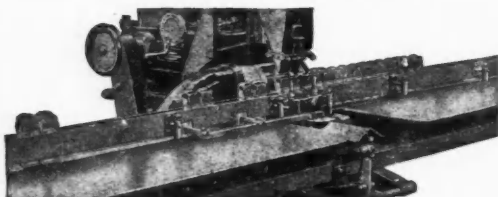
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